Originally our group had chosen the diagnosis of diseases based on symptoms as our project topic. We quickly realized that such a subject was far too broad in order to be able to create some sort of prototype in prolog so we decided to narrow it down much further. After researching various types of documents provided by the National Comprehensive Cancer Network (NCCN), which provided clinical practice guidelines for multiple different types of cancer, we decided on bone cancer as our disease of interest.
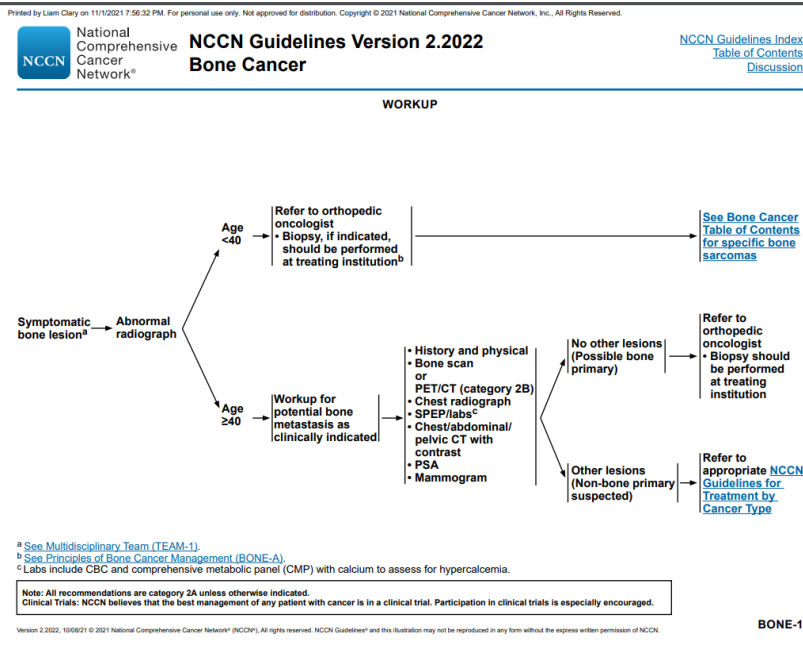
What is the NCCN?

The NCCN is an alliance of 31 cancer centers all based in the United States. They are a non-profit organization that publishes various guidelines on how to diagnose and treat various types of cancer. Their goals as an organization are, according to the NCCN, "To improve and facilitate quality, effective, efficient, and accessible cancer care so patients can live better lives" .

Neat! But how does that relate to belief revision?

Belief revision at its core is changing beliefs in order to take new information into account. Where is this seen in cancer treatment? The guidelines mentioned earlier that have been published by the NCCN contain several documents that have decision trees that are used in order to guide those that are attempting to give proper treatment to cancer patients. These diagrams are extremely detailed and leave little to nothing to the imagination. Making sure that the statements are read as facts is important to building a knowledge base. These documents are always kept up to date with recent finds in the field of cancer research which in itself is a form of belief revision! The document we will be using was updated as recently as October 8th of this year.

Could we see an example?

NCCN National Comprehensive Cancer Network®

NCCN Guidelines Version 2.2022
Bone Cancer

WORKUP

Symptomatic bone lesion[a] → Abnormal radiograph

- Age <40 → Refer to orthopedic oncologist
  - Biopsy, if indicated, should be performed at treating institution[b]
  → See Bone Cancer Table of Contents for specific bone sarcomas

- Age ≥40 → Workup for potential bone metastasis as clinically indicated
  - History and physical
  - Bone scan or PET/CT (category 2B)
  - Chest radiograph
  - SPEP/labs[c]
  - Chest/abdominal/pelvic CT with contrast
  - PSA
  - Mammogram
  → No other lesions (Possible bone primary) → Refer to orthopedic oncologist
    - Biopsy should be performed at treating institution
  → Other lesions (Non-bone primary suspected) → Refer to appropriate NCCN Guidelines for Treatment by Cancer Type

[a] See Multidisciplinary Team (TEAM-1).
[b] See Principles of Bone Cancer Management (BONE-A).
[c] Labs include CBC and comprehensive metabolic panel (CMP) with calcium to assess for hypercalcemia.

Note: All recommendations are category 2A unless otherwise indicated.
Clinical Trials: NCCN believes that the best management of any patient with cancer is in a clinical trial. Participation in clinical trials is especially encouraged.

BONE-1

This is one of the pages of the guidelines and it provides a simple example. So let's assume we have some ==facts in our knowledge base==: those being, we have a patient that has a symptomatic bone lesion,that the radiograph performed on them yielded abnormal results, and that they are younger than 40 years old. With all of those facts we can follow the tree branches (or in prolog terms: ==use our rules==) in order to revise our belief about what we should do with the patient next. This states that we should refer the patient to an orthopedic oncologist and perform a biopsy on the area we believe to contain a tumor. After diagnosing the specific condition we can move to the table of contents and move to that tree. Clearly there is a structure here mirroring belief revision as we are learning new things and acting accordingly based on the new information that is being presented to us.

Modeling the World

So, as we've just seen in the previous example, modeling the world would involve having a list of facts that we know about the patient and rules that can return actions to perform and new facts based on what we already know. It's likely that each of these guideline pages would have their very own rule in order to properly add facts from the previous rules into the knowledge base. Using those new facts we can use different rules to generate more facts and the cycle continues until the patient's cancer is properly treated.

Works Cited

"National Comprehensive Cancer Network - Home." *NCCN*, https://www.nccn.org/.

"Treatment by Cancer Type." *NCCN*, https://www.nccn.org/guidelines/category_1.